

CLAIM LISTING

1. (Original) A method for operating a reciprocating internal combustion engine equipped with a lean NOx trap on gaseous hydrogen, comprising the steps of:  
operating the engine at an equivalence ratio of about 0.15 to 0.65, except when purging the lean NOx trap; and  
operating at an equivalence ratio of about 1.1 when purging the lean NOx trap.
2. (Original) A method according to Claim 1, further comprising the step of operating the engine with the mass of EGR being approximately equal to the mass of air and fuel when the lean NOx trap is being purged.
3. (Original) A method according to Claim 1, further comprising the step of operating the engine with the mass of EGR being approximately equal to the mass of air and fuel when the lean NOx trap is being purged and when the engine is operating at or near maximum load.
4. (Previously Presented) A method for operating a reciprocating internal combustion engine, comprising the steps of:  
providing substantially premixed air and hydrogen to a combustion chamber of the engine wherein said air and hydrogen are at an equivalence ratio of approximately unity; and  
providing residual gases to the combustion chamber, with the mass of the residual gases exceeding 40% of the total mass of gases provided to the combustion chamber.
5. (Original) A method according to Claim 4, wherein the residual gases comprise engine exhaust gas trapped in the combustion chamber from a prior combustion event and engine exhaust gas recirculated to the combustion chamber.
6. (Original) A method according to Claim 4, wherein the engine has a three-way catalyst disposed in an exhaust system connected to the engine.
7. (Previously Presented) A method for operating a hydrogen fueled spark ignition engine having an associated lean NOx trap, the method comprising:  
operating the engine at a lean air/fuel ratio with a first level of residual exhaust gases;  
determining when to purge the associated lean NOx trap; and

enriching the air/fuel ratio and increasing the residual exhaust gases to avoid auto ignition while purging the NOx trap in response to a purge determination.

8. (Previously Presented) The method of claim 7 wherein the step of enriching the air/fuel ratio comprises reducing the air/fuel ratio to about a stoichiometric air/fuel ratio.

9. (Previously Presented) The method of claim 7 wherein the step of enriching the air/fuel ratio comprises reducing the air/fuel ratio to a ratio rich of stoichiometry.

10. (Previously Presented) The method of claim 7 wherein the step of operating the engine comprises operating the engine at an equivalence ratio of between about 0.15 to 0.65 based on engine speed and load.

11. (Previously Presented) The method of claim 7 wherein the residual exhaust gases comprise exhaust gas recirculation and exhaust gas trapped in a combustion chamber from a previous combustion event.

12. (Previously Presented) The method of claim 7 wherein the step of enriching the air/fuel ratio and increasing the residual exhaust gases comprises increasing the residual exhaust gases to about 40-80% of the mass of air and fuel.

13. (Previously Presented) The method of claim 7 wherein the engine is a port fuel injected internal combustion engine.

14. (Previously Presented) A method for controlling a hydrogen fueled spark ignition engine having an associated lean NOx trap, the method comprising:

supplying gaseous fuel consisting essentially of hydrogen to operate the engine with a lean air/fuel ratio;

determining when to purge the lean NOx trap; and

supplying hydrogen to the lean NOx trap in response to the step of determining when to purge.

15. (Previously Presented) The method of claim 14 further comprising enriching the air/fuel ratio to operate the engine at an equivalence ratio not less than unity during purging of the lean NOx trap.

16. (Previously Presented) The method of claim 14 wherein the step of supplying hydrogen comprises supplying hydrogen downstream of a combustion chamber of the engine and upstream of the lean NOx trap during purging of the lean NOx trap.

17. (Previously Presented) The method of claim 14 further comprising increasing mass of residual exhaust gases relative to mass of air and fuel to reduce auto ignition during purging.

18. (Previously Presented) A hydrogen fueled spark ignition engine comprising:  
a fuel system for supplying gaseous hydrogen to cylinders of the engine;  
a lean NOx trap coupled to an exhaust stream of the engine;  
an injector for selectively supplying hydrogen downstream of the engine and upstream of the lean NOx trap during purging; and  
a controller for determining when to purge the lean NOx trap based on engine operating conditions and controlling the injector to selectively supply hydrogen to the lean NOx trap during purging.

19. (Previously Presented) The engine of claim 18 further comprising:  
an EGR system for providing recirculated exhaust gas to the engine;  
wherein the controller operates the EGR system to increase EGR flow during purging of the lean NOx trap to reduce auto ignition of the gaseous hydrogen fuel.

20. (Previously Presented) The engine of claim 18 wherein the engine operating conditions include engine operating time.

21. (Previously Presented) The engine of claim 18 wherein the engine operating conditions include engine speed and load.

22. (Previously Presented) The engine of claim 18 wherein the controller operates the fuel system to enrich the air/fuel ratio during purging of the lean NOx trap.

23. (Previously Presented) The engine of claim 18 wherein the controller operates the fuel system to provide an equivalence ratio of not less than unity during purging of the lean NOx trap.

24. (Previously Presented) An electronic storage medium having stored data representing instructions executable by a microprocessor to control a hydrogen fueled spark ignition engine having an associated lean NOx trap, the electronic storage medium comprising:

instructions for controlling a fuel system to supply gaseous hydrogen to cylinders of the engine to operate at a lean air/fuel ratio;

instructions for determining when to purge the lean NOx trap based on engine operating parameters; and

instructions for supplying hydrogen to the lean NOx trap in response to determining when to purge the lean NOx trap.

25. (Previously Presented) The electronic storage medium of claim 24 further comprising instructions for enriching the air/fuel ratio during purging of the lean NOx trap.

26. (Previously Presented) The electronic storage medium of claim 24 further comprising:

instructions for enriching the air/fuel ratio and increasing EGR during purging of the lean NOx trap to avoid auto ignition..